**Public Lands Transportation Scholar**
**Final Report**

# Improving Safety for Pedestrians and Cyclists at the Entrance to Don Edwards San Francisco Bay National Wildlife Refuge: A Description of the Process and Results of a Road Safety Audit

**April 2014**

Paul S. Sarbanes Transit In Parks Technical Assistance Center

UNDERSTANDING RESOURCES SOLUTIONS

*This document was prepared for Federal Transit Administration by the Paul S. Sarbanes Transit in Parks Technical Assistance Center.*

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# ABSTRACT

Over a ten-month period in 2013 and 2014, Public Lands Transportation Scholar Matthew Bruno assisted the San Francisco Bay National Wildlife Refuge (NWR) Complex in improving the entrance area of Don Edwards San Francisco Bay National Wildlife Refuge (DESFBNWR) for pedestrians and cyclists. A Road Safety Audit (RSA) was used to bring stakeholders together, identify safety issues, and collaborate to develop potential solutions.

The primary focus of the scholar was to coordinate the RSA and follow up with participants in the development and implementation of the solutions identified in the process.

A secondary focus was to expand upon the work begun with the RSA and further develop partnerships and funding opportunities in order to bring about improvements beyond the RSA area.

# INTRODUCTION

The San Francisco Bay National Wildlife Refuge Complex is a collection of seven National Wildlife Refuges (NWR) administered by the U.S. Fish and Wildlife Service (FWS): Don Edwards San Francisco Bay NWR, San Pablo Bay NWR, Antioch Dunes NWR, Marin Islands NWR, Elicott Slough NWR, Salinas River NWR, and Farallon Islands NWR.

In 2012, a transportation scholar evaluated the transportation needs at each of the refuges in the complex. The evaluation was created as part of the Public Lands Transportation Scholars program. The Federal Transportation Administration (FTA), through the Paul S. Sarbanes Transit in Parks (TRIP) program, funded Matthew Bruno, a transportation planner based in the Bay Area, to work for a ten-month period with the San Francisco Bay NWR Complex.

In the creation of the transportation evaluation, one issue stood out above the others: increasing safety around the entrance to the refuge headquarters at Don Edwards San Francisco Bay NWR (referred to as 'the refuge' for the remainder of this document). Counts at the entrance showed that a full quarter of the people visiting the refuge were either biking or walking in; however, the road leading up to the refuge does not have bike lanes and neither the refuge nor the connecting roads have sidewalks near the entrance area. Creating consistent and connected facilities are a key element of improving pedestrian and cyclist safety. Since multiple owners have responsibility for the roads surrounding the entrance area, a coordinated effort was necessary. For this reason, a Road Safety Audit (RSA) was considered the best tool for evaluating and addressing safety concerns.

An RSA, as defined by the Federal Highway Administration, is a "formal safety performance evaluation of an existing or future road intersection by an independent, multidisciplinary team." The refuge used the RSA process to bring together refuge staff, an RSA consultant, and local stakeholders (referred to herein as the RSA team) for a two day, on-site evaluation of the entrance area. The transportation scholar worked with the professional RSA consultant to assemble a data packet for the RSA area prior to the meeting. On the morning of the first day, the RSA began with a discussion of the process and the data provided in the packet. The RSA team then went out to observe the actual road conditions both during the day and at night. On the morning of the second day, the team went out to observe morning rush hour traffic. The data and personal observations from the first day were then compiled. In the late morning of the second day, the RSA team began the process of defining the problems and looking for possible solutions. After the RSA concluded, a formal report was completed by the consultant and released to all of the stakeholders and the implementation process began (see

Appendix 1 for a complete copy of the final report and more detailed information about many of the issues described in this document).

The scholar worked with the refuge and the local stakeholders to move forward with the recommendations of the RSA. This report describes both the RSA process and the efforts to implement the recommendations made in the RSA report.

# METHODOLOGY

The RSA process began in January of 2013 as a technical assistance request to the Transit in Parks Technical Assistance Center (TRIPTAC). TRIPTAC assigned their partner organization, Vanasse Hanglin Brustlin (VHB), to serve as a consultant on the project. Once the funding was in place, the transportation scholar developed a list of relevant stakeholders to participate in the RSA. The final list of participants included refuge planning staff, refuge law enforcement, the transportation coordinator for the regional FWS office, the City of Newark Department of Public Works, the City of Newark Department of Community Development, the City of Newark Police Department, the Bay Trail, and management of Aloft Hotel, the nearest business to the refuge.

Once the participants had been established, a date for the RSA was set. Because the RSA involved participants from different organizations that did not often coordinate, everyone was contacted in early March to discuss possible dates for July or August. After everyone involved consulted their schedules, the RSA was set for August 6th and 7th of 2013.

When the scholar returned to the refuge for the second year of his contract period in June 2o13, he began collecting the data necessary to conduct the RSA (see Section 2 of the final RSA report, shown in Appendix 1, in order to review the data described below). This included the following items:

- Aerial photographs of the study area
- Available data on traffic collisions from January 2009 forward
- Bicycle and pedestrian counts
- Traffic volumes

The scholar obtained traffic volumes and collision data from the City of Newark. The scholar used Google Earth to create a map that showed the location of traffic incidents. The scholar obtained data on bicycle and pedestrian activity as well as truck traffic on the road by performing peak hour counts over a series of several days. The data was organized and placed on PowerPoint slides to be added to the standard presentation that VHB consultants used to explain the RSA process.

The RSA itself began at 9:00 a.m. on Tuesday, August 6, 2013. The invited participants met in the conference room and VHB went over the RSA process in detail. From 10:00 a.m. to noon, the RSA team went out to the RSA site for a preliminary overview of the roads involved in the study area. After lunch, a more thorough survey of the area was conducted, included taking note of how traffic operated during the peak afternoon commute hours. After dinner, a final hour of site analysis took place in order to observe conditions on the road after dark.

The next day, the RSA team met at 7:00 in the morning to observe morning peak hour traffic. Problem areas identified the day before were revisited for continued examination. After lunch, the consultants used the early part of the afternoon to put together a rough presentation of the early observations and findings. This presentation was given to the entire RSA team in the late afternoon and the preliminary findings along with possible solutions were discussed by all present. This process concluded the two-day RSA process.

The VHB consultants released a draft report two months later that presented the findings in detail. The report was organized by road section. It presented potential short and intermediate-term solutions and identified the agency or road owners that would need to be responsible for implementing the changes.

The scholar provided initial feedback on the draft that reflected the refuge's concerns and long-term goals. The report then went out to all the stakeholder who reviewed the findings and provided feedback. The participants were on the whole satisfied with the suggestions made in the report. The city and other groups suggested small changes that mostly consisted of updates to the information about road or land ownership, as various areas had been further researched after the RSA ended.

After the release of the report, the scholar met with the individual stakeholders to discuss feasibility and timelines for each of the solutions identified in the report. The implementation section of this report will discuss the progress made.

# CONSTITUENCIES

Nine different groups participated in the RSA process. How they became involved and their role in the RSA is described below.

## Vanasse Hanglin Brustlin (VHB)

The transportation consulting firm VHB became involved with the RSA through its relationship as a TRIPTAC partner organization. TRIPTAC assigned VHB as the liaison for the refuge's RSA technical assistance request. VHB has performed RSA's on public lands throughout the United States and has a long history of using the process to bring about improvements. One of the VHB consultants working on the RSA, Dan Nabors, wrote the RSA guide, "Road Safety Audit Toolkit for Federal Land Management Agencies and Tribal Governments." VHB created the schedule for the RSA and used their experience to direct participants towards areas of concern and suggest possible solutions. After the RSA, they worked with the transportation scholar to create the final report outlining short and intermediate-term solutions.

## Refuge Planning Staff

Refuge planning staff included the transportation scholar; Jennifer Heroux, the Chief of Visitor Services; Eric Mruz, the refuge manager; and Anne Morkill, the refuge complex's project leader. The transportation scholar made sure that members of the refuge planning staff understood what was happening with the RSA during all the various stages of the process. The Chief of Visitor Services brought knowledge of the groups that visit the refuge, including how they arrive and how they use the refuge. The refuge managers made sure that any changes proposed during the RSA did not conflict with either refuge conservation goals or other long-term projects the refuge had in place.

## FWS Region 8 Office

Robyn Flaherty, the transportation coordinator for FWS Region 8, stayed closely involved with the RSA process. The regional office had an interest in not only using the results to improve Don Edwards San Francisco Bay NWR, but how the RSA process could be used to bring about improvements to other refuges in the region. Involvement by the regional office will also prove helpful for any improvements that required the use of federal funds.

## Refuge Law Enforcement

The refuge has its own law enforcement staff responsible for patrolling the refuge complex. A representative of refuge law enforcement, Jared Klein, attended the opening meeting and the initial site visit to describe his experience patrolling the entrance area.

He discussed not only safety concerns but also how different user groups use the area and how safety improvements could work together with efforts to reduce undesirable behavior around the entrance area.

## City of Newark Department of Public Works

The City of Newark owns and manages the roads around the refuge entrance and the department of public works plans and schedules road improvement projects. The involvement of the department of public works was therefore essential for the implementation of suggestions made in the RSA. Soren Fajeau, the Senior Civil Engineer for the city, was one of the first people contacted after the refuge received funding for the RSA and the potential dates for the RSA were set around his availability. Because he had knowledge of all the scheduled projects for the city, as well as, the process for implementing suggested improvements, his feedback on the observations and potential solutions helped shape the final report results.

## City of Newark Department of Community Development

As the Don Edwards San Francisco Bay NWR is the largest urban refuge in the United States, the city uses it to help attract new commercial and residential developments. Improving the connectivity between the refuge and rest of the city is therefore of importance to the Department of Community Development. Terrance Grindall, the Community Development Director for the City of Newark, was particularly interested in how the RSA process could help connect the refuge with a new housing development being built just south of the refuge entrance. He also had detailed knowledge of both the history of the area and future plans and projects that might affect the implementation of proposed solutions.

## City of Newark Police Department

The City of Newark Police Department patrols the area immediately outside the refuge boundaries. An officer from the police department spoke at the opening meeting of the RSA process about the incident history in the area and the enforcement strategies the city uses.

## The Bay Trail

The Bay Trail is an organization within the Association of Bay Area Governments dedicated to the improvement and completion of a pedestrian and cyclist trail that completely surrounds the bay. The refuge entrance area is designated as part of this trail system and had been identified by the Bay Trail as an area in need of improvement. Lee Huo, the Bay Trail Planner responsible for the area, attended the RSA and discussed the work his organization has already done in the area. He was also able to identify funding sources offered by the Bay Trail that could assist in the implementation process.

## Aloft Hotel Management

The Aloft Hotel is the nearest business to the refuge. Located a half mile from the refuge entrance, the management uses the hotel's proximity to the refuge as a selling point to attract guests. Michael Mahoney, the CEO of the management group that operates the hotel, expressed an early interest in the project and attended the RSA meeting along with several members of his management staff. The hotel had long been aware of safety issues on the road leading into the refuge. Hotel staff identified the circuitous route they had been advising people to take in order to avoid an intersection without any pedestrian facilities and related the concerns they had heard from their guests. The hotel managers confirmed the observations made by the transportation scholar and were useful in showing the city how improvements could benefit the local economy.

# RSA RECOMMENDATIONS

The RSA process resulted in a detailed list of recommendations for improving the entrance area (for a complete list of recommendations including maps and summary tables, see Section 3 of the RSA final report shown in Appendix 1). The recommendations had the goal of creating the greatest possible separation between motorized and non-motorized traffic.

The recommendations were divided into two sections: short-term improvements and intermediate-term improvements. The following is a brief summary of the key short and intermediate-term improvements that the report suggests:

## Short-Term Improvements

- Increasing speed enforcement on the road leading into the refuge.
- Installing bike warning signs with Share the Road plaques on the road leading up to the refuge.
- Conducting an education campaign to increase motorist awareness of pedestrians and bicyclists in the area.
- Trimming the shrubbery along the roadside to increase visibility.
- Changing the signal timing at the intersection nearest the refuge to allow for clearance by cyclists.

## Intermediate-Term Improvements

- Narrowing the traffic lanes on both sides of the road leading to the entrance and adding six foot bike lanes on both sides of the road.
- Installing a marked crosswalk with pedestrian signal and landing area at the intersection nearest the refuge entrance.
- Adding a sidewalk from the new pedestrian crossing to the refuge entrance.
- Opening the levy trail near the entrance to provide a direct connection with the new sidewalk.
- Completing the sidewalk that starts south of the refuge so that it connects to the refuge entrance.
- Conducting a study to examine how to best connect the refuge with the planned development being constructed just south of the refuge entrance.

# NEXT STEPS / IMPLEMENTATION

After the release of the final report from the Road Safety Audit, the refuge worked with the City of Newark to begin implementation of the recommendations. Some of the short-term strategies were implemented immediately. The city cut the bushes along the side of the road that reduced the visibility of cyclists and pedestrians. They made a priority the retiming of the traffic signal at Gateway and Thornton Avenue to allow clearance by cyclists. The refuge also had meetings with the city to discuss the time frame for intermediate-term improvements. The recommendations for bicycle and pedestrian facilities leading to the refuge entrance were taken seriously by the city and a plan was made for collaboration during the road's upcoming scheduled repaving.

## Further Collaboration

The RSA also led to further collaboration between other RSA participants. The RSA's benefits proved to be not only the safety recommendations included in the final report but also the building of connections between groups that did not previously recognize how much they could accomplish by working together. With various follow-up projects already in place, these connections will remain after the scholar leaves and may lead to a variety of improvements beyond those envisioned in the original RSA. Some examples are shown below:

- After the RSA process, the transportation scholar learned new information about what appeared to be a social trail connecting the road leading through the refuge to city streets. The path was actually a formal trail that had been fenced off because of lack of pedestrian facilities on the city on one end of the trail (see Figure 9 in the RSA final report in Appendix 1 for a detailed map of the area). Because the trail was designated for public access, the fence that blocked the entrance could be removed if the city added pedestrian facilities at the end of the trail. This trail connection would provide easy and safe access to refuge for guests of the nearby hotel. When this information was shared with the hotel management that had attended the RSA, they placed a formal request with the city to implement the RSA recommendations of a crosswalk and sidewalks at the intersection nearest the hotel. Since the sidewalk would only have to go as far the refuge trail, the city could build it at costs considerably less than constructing a sidewalk to the main entrance of the refuge. The city is currently reviewing the details of this project in order to make a determination about implementation.
- The RSA process also led to a possible collaboration between the refuge and the Bay Trail. During the RSA process, the refuge became aware of a grant that the Bay Trail awards to projects that work to improve and complete the Bay Trail. Because the area of the RSA is part of the Bay Trail, the refuge would be eligible

for this funding. The scholar prepared a grant application that would fund a feasibility study that would provide more detail on the intermediate steps recommended in the RSA. The feasibility study would describe the possible environmental impacts of each of the recommendations, create specific designs, and give a cost estimate for construction. The grant would cover a study of improvements not only in the RSA area, but on the connecting road that runs through the refuge, allowing for improvements along the entire corridor. The grant will be submitted later this year. If the grant application is approved, the feasibility study will greatly improve the chances of finding funding for the construction of the intermediate-term projects identified in the RSA.

- The RSA process also allowed for the further development of two long-term projects at the refuge. The first involves a parking lot just outside the gates of the refuge entrance that has long presented problems for law enforcement and been a source of concern for the private company that owns the parking lot. The RSA recommended closing this parking lot. This led to a new discussion between the private owner and the refuge about transferring ownership of the property to the refuge and restricting access to the lot. The other project involves the replacement of a small bridge just inside the entrance gates to the refuge. The bridge replacement will require repaving the road section between the bridge and the main entrance. Having the final RSA report prepared before the bridge replacement plan had been finalized allowed the refuge to argue for improved pedestrian facilities on and around the bridge that would connect with the intermediate-term improvements recommended for the entrance area by the RSA.
- The RSA also led to improvements beyond the refuge itself. The transportation coordinator for Region 8 was impressed by the results that followed the RSA progress and invited the transportation scholar to Colusa National Wildlife Refuge near Sacramento to consider the effectiveness of conducting an RSA in order to address safety concerns there. The scholar collected data about the existing conditions of transportation facilities and traffic patterns at Colusa NWR and spent two days at the refuge working on determining the scope of a potential RSA.

# CONNECTION TO WIDER TRANSPORTATION COMMUNITY

The RSA process is an extremely useful tool to be used by any organization dealing with transportation safety issues that involve different jurisdictions or concern a variety of different stakeholders. The wide applicability of the RSA process used at Don Edwards San Francisco Bay NWR was demonstrated by the interest the FWS regional coordinator took in applying it to another refuge in the region as soon as possible. In the experience of the transportation scholar, the RSA process is an effective tool because it combines professional experience, personal observation, and collaborative problem solving.

The RSA process at the refuge was led by two transportation consultants with years of experience in conducting RSA's. Their experience allowed them to see issues that had been overlooked by people who had been using the road for years. For example, a divided road sign had been installed upside down so that it warned for the beginning of a divide rather than the end. The consultants saw this immediately where it had been missed by all others. More importantly, the RSA consultants had up-to-date knowledge of possible solutions after the problems had been identified. They were able to state whether or not the warrants were met for a particular treatment (e.g., adding a traffic signal) and able to help the participants articulate what they were trying to express in terms of transportation planning and engineering. The consultants also kept the process moving forward in a structured and coherent manner. When considering using the RSA process in the wider transportation community, having team members who are experienced in conducting an RSA will definitely improve the benefits that come from using the tool.

The RSA process, however, goes beyond simply hiring transportation professionals to evaluate a safety issue. Everyone who participated in the process contributed their own knowledge of the area and came up with new ways of looking both at the problems and the possible solutions. The hotel manager showed the RSA team an informal trail that led from the hotel to the refuge that no one else in the group had seen before. Law enforcement officials described incidents that the refuge had not previously heard of. The community development director understood the history of the area and knew the ownership of parcels that the refuge did not have the records for. Further, each group also had its own constituency to represent in terms of where and how safety improvements should be implemented, and this allowed for a robust discussion of what areas and solutions to prioritize.

The discussions between different stakeholders proved to be one of the most valuable elements of the RSA process. When the different groups came together, they recognized that they shared a variety of common goals and that they could put their resources together in order to accomplish them. While this was expected in terms of bringing

about safety improvements in the area, the discussion also led to areas beyond the RSA study area and collaboration continued after the formal RSA process ended. When considering the benefits of using the RSA process as a tool in the wider transportation community, the long-term partnerships and collaborations that may result are difficult to predict but could end up bringing about long-term positive changes long after the RSA process has concluded.

# THE PUBLIC LANDS TRANSPORTATION LANDSCAPE

In working in a federal public lands environment, the greatest transportation planning challenge has been matching long-term funding and project cycles with the short-term nature of the position. In terms of the RSA, many of the intermediate-term solutions can only be implemented in conjunction with other long-term projects. For example, the funding and project timing for the bridge replacement project that is occurring on the refuge was set prior to the arrival of the scholar. The engineering team that will determine the striping configuration for the new road surface has a very limited number of options for the design and construction of the bridge and road surface. They want to finalize the structural engineering before considering specific surface treatments that might benefit cyclists and pedestrians. While the scholar was able to provide input into what treatments he hopes will make the approved plans, the final decisions will be made outside of his tenure. Similarly, the scholar had originally been set to work on the regional long range transportation plan. The schedule for the long range planning process, however, ended up being shifted to outside of the scholar's work term. In the public lands transportation landscape, the scholar's time at the refuge is set by necessity of running a program on a uniform schedule, and so the scholar must adjust the scope of work to match the schedule of available projects.

The scholar was able to adjust to some of the time frame issues by both creating new projects and performing work in advance so when the funding arose, the project would be ready for implementation. For example, when the regional work with the long range transportation plan became delayed, the scholar looked for other opportunities to help at a regional level. This led to a project collecting transportation data at Colusa NWR and performing a site visit there to determine the scope of a potential RSA.

Advance work was also done on a grant application that will not be open for submission until after the scholar's tenure. The scholar used the previous year's (i.e. 2013) grant application to complete a draft version of the grant for the 2014 submission. When this year's grant application process opens, the refuge should be able to use the draft grant submission created by the scholar, hopefully without modification.

Outside of the time and scheduling concerns – a part of any temporary project – the scholar found working on transportation projects in a public lands context a rewarding way to put his planning skills to use. One of the beneficial elements of transportation planning for the Fish and Wildlife Service is the depth of concern and knowledge everyone has for environmentally sustainable planning practices.

# CASE STUDY FOR FUTURE PUBLIC LANDS TRANSPORTATION SCHOLARS

During my second year as a transportation scholar, I felt more comfortable in my work environment and had a better understanding of the resources available to me than in my first year. The relationships I had built during my first year allowed me to bring together the participants for the RSA without much difficulty and also know which staff members to consult when I had questions about the refuge. This made accomplishing my work tasks much easier than in the first months as a transportation scholar, when I was uncertain about what my co-workers did and, as they were mostly biologist, was not sure if we shared the same professional language. When I think back on what contributed most to my success in the program, I believe it was taking the time to learn about what my co-workers were working on and becoming involved, even if only in a limited way, with their projects. For example, last month, I volunteered to help eradicate non-native spinach plants on the Farallon Islands. Heavy rains on one of the spraying days kept us indoors and I ended up spending the afternoon with a program manager for the refuge working out a cost-benefit analysis for chartering a boat versus purchasing a boat. Conducting this evaluation had been discussed for some time, but his busy schedule had prevented it from moving forward. My involvement in his work opened the space for working on a collaborative transportation project. More than creating time to move forward with projects, spending time with my co-workers allowed me to learn at least the very basics of their professional language, helping me understand their concerns when I discussed my transportation projects with them. It also allowed me to learn more about environmental issues than I had in any of my other previous planning positions.

Beyond my particular worksite, I enjoyed getting to know the other scholars and attending TRB with them. Many of the scholars from my first year returned during my second year, and just as I felt more comfortable in my second year relying on my co-workers as resources, I also felt more comfortable discussing questions and concerns with my fellow transportation scholars. TRB provided a great opportunity to reconnect with both the other scholars and the program organizers. This second year, I also had a much better sense of how to manage my time during TRB, although it was still a challenge, due to the overwhelming amount of activity at the conference. This year seems to have gone by just as quickly as TRB itself, and I'm grateful for all of the experiences I have had through the transportation scholar's program.

# PROFESSIONAL DEVELOPMENT

Last week, I sent a friend a picture I had taken on the refuge. He said he looked for the spot on Google Earth but had a hard time finding it because the lake was dried up in the satellite imagery he was looking at. I didn't know what lake he was referring to until I went back and realized he was referring to some tidal wetlands. I then had the further realization that I would also have thought that was a dried up lake prior to working for the refuge. By working with and living in a housing area with people who take a basic understanding of the natural world as a given, I have learned a great deal about how environmental systems are monitored, regulated, and managed. Prior to this position, I worked on projects that required environmental review, and while I understood the formal requirements of the process, I didn't fully understand the reasons behind much of it. This job has greatly increased my understanding of environmental issues and I believe this will help me put environmental review work into context in future positions.

I have also had the opportunity to put together several grants during my time at the refuge. This is a skill that nearly every organization seems to look for, and I'm glad that I now possess some basic experience with it. I've also been able to develop my skills using ArcGIS and some of the technical capabilities of Google Earth.

One of the more enjoyable elements of my professional development here has been being relied upon for transportation advice whether or not I am knowledgeable in the area being asked about. Many of the co-workers that I do not work with directly know me only as the transportation person. When they have a question about their commute or something transportation related they heard about in the news, they often come to me to ask about it, with the follow-up response often involving me taking a few minutes to go online and learn about the issue and then come back to them with an answer. From this process, I have learned a great deal about both the transportation environment in the local area and new transportation developments in general.

I've greatly enjoyed my time as a transportation scholar and I'm certain that the changes this position has brought in how I see the environment around me will shape my life both personally and professionally for years to come.

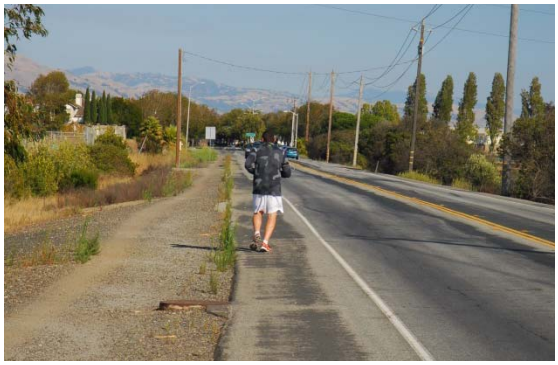
# APPENDIX 1: PEDESTRIAN AND BICYCLE ROAD SAFETY AUDIT FINAL REPORT

# Thornton Avenue (from Gateway Blvd. to Willow St.)

# Pedestrian and Bicycle Road Safety Audit Report

Newark, CA

August 6-7, 2013



Prepared by

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Prepared for

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

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# 1. INTRODUCTION

## 1.1 BACKGROUND

The purpose of this study is to conduct a Pedestrian and Bicycle Road Safety Audit (RSA) for a portion of Thornton Avenue in Newark, CA, in the vicinity of the Don Edwards San Francisco Bay National Wildlife Refuge.

Don Edwards San Francisco Bay NWR was the nation's first urban national wildlife refuge, and encompasses approximately 30,000 acres on the southern end of San Francisco Bay. The Refuge is part of the San Francisco Bay National Wildlife Refuge Complex, which includes seven Refuges in the Bay Area. Don Edwards San Francisco Bay NWR is co-managed by the U.S. Fish and Wildlife Service (FWS) and Cargill, Inc., which operates a series of commercial salt ponds within the Refuge's borders.

Don Edwards San Francisco Bay NWR is a popular East Bay destination for bicycling and hiking. Thornton Avenue provides vehicular, bicyclist, and pedestrian access to the Refuge, the surrounding tri-city communities of Newark, Fremont, and Union City, and the Dumbarton Bridge (via SR 84). With relatively high motorized vehicle speeds and non-contiguous pedestrian and bicycle accommodations, Thornton Avenue can be inhospitable to bicyclists and pedestrians, making it difficult to access to the Refuge by bicycle or on foot. In light of these conditions, the U.S. Fish and Wildlife Service requested a pedestrian and bicycle RSA be conducted on Thornton Avenue in order to evaluate safety performance, identify potential safety issues and recommend opportunities for safety improvements for all road users of Thornton Avenue.

The pedestrian and bicycle RSA was conducted on August 6-7, 2013, and included field observations conducted during morning and evening peak hours, as well as a nighttime field review. The RSA Team included representatives from the following agencies and organizations:

- Refuge law enforcement
- Refuge planning staff
- FWS Region 8 office
- City of Newark Department of Public Works
- City of Newark Department of Community Development
- City of Newark Police Department
- San Francisco Bay Trail
- Aloft hotel management
- VHB, Inc.

## 1.2 Study Area

The study area, shown in Figure 1, encompasses an approximately 1.2-mile stretch of Thornton Avenue between Gateway Boulevard and Willow Street. Generally, Thornton Avenue is oriented in a southeast-northwest direction, and features a horizontal curve in the vicinity of the Refuge entrance at Marshlands Road. The speed limit on Thornton Avenue in the study area is 45 mph. Thornton Avenue is a designated truck route in the City of Newark, and provides connectivity between the SR 84 freeway and the industrial areas located to the south and east of the study area.

The study area has relatively high levels of both recreational and commuter bicyclist activity. The Refuge's bike facilities, along with a connection to additional trails in Coyote Hills Regional Park, attract a large number of recreational bicyclists to the Refuge. There is also a significant amount of commuter bike traffic, as Marshlands Road provides the only access to the bike/ped crossing on the Dumbarton Bridge. The Dumbarton Bridge represents the lone bike/ped connection between the East Bay and the Peninsula, making Thornton Avenue and Marshlands Road part of one of the most important ped/bike routes in the Bay Area.

Ideally, bicyclists should ride with traffic and pedestrians should walk against traffic or on a two-way facility separated from the roadway in order to reduce travel risk. Gaps in existing ped/bike accommodations do not allow pedestrians and bicyclists to meet this ideal.

**Figure 1: Study Area Map**

# 2. EXISTING CONDITIONS

## 2.1 SITE CHARACTERISTICS

**INTERSECTIONS AND SEGMENTS**

For ease of analysis, the study area was divided into four distinct units, including two intersections and two roadway segments between intersections.

**Intersection #1: Thornton Avenue at Gateway Boulevard** is a signalized T- intersection at the northwestern end of the study area (Figure 2). The SR 84 freeway interchange, which provides access to the Dumbarton Bridge to the west and to I-880 to the east, is located approximately 1,000 feet from this intersection. All three approaches to the intersection feature medians. The EB approach of Thornton Avenue features one through lane and two left-turn lanes, with a protected left-turn phase. The WB approach of Thornton Avenue features two through lanes and a right-turn lane. The SB approach of Gateway Boulevard features one left turn lane and two right-turn lanes, with a protected right-turn phase that runs concurrent with the EB left/through phase. There is a sidewalk and a marked bike lane on the WB approach to the intersection.

Figure 2: Intersection #1 - Thornton Avenue at Gateway Boulevard

**Intersection #2: Thornton Avenue at Marshlands Road/Cargill Lot** includes two intersections that provide access to the Refuge (Figure 3). The intersection of Thornton Avenue at Marshlands Road serves as the main entrance to the Refuge, and includes signage designating it as such. The EB approach of Thornton Avenue features a shared through/right lane. The WB approach features a through lane and a left-turn lane. The NB approach of Marshlands Road features a shared left/right lane. Approximately 500 feet east of the Thornton Avenue/Marshlands Road intersection is the entrance to a paved parking area termed the Cargill Lot, thus named because it is owned by Cargill, Inc. The intersection of Thornton Avenue and the Cargill Lot entrance serves as an informal secondary access point for the Refuge.

**Figure 3: Intersection #2 - Thornton Avenue at Marshlands Road/Cargill Lot**

**Segment #1: Thornton Avenue between Gateway Boulevard and Marshlands Road** includes the western portion of the study area, and features sharply contrasting roadway characteristics (Figure 4). A sidewalk and a marked bike lane are located on the north side of Thornton Avenue. Thornton Avenue is divided in this section, with 2 WB lanes and 1 EB lane. The ped/bike facilities and median end approximately ¼ mile east of Gateway Boulevard, where Thornton Avenue becomes an undivided two-lane roadway, with undeveloped land on both sides of the roadway.

Figure 4: Segment #1 - Thornton Avenue between Gateway Boulevard and Marshlands Road


**Segment #2: Thornton Avenue between Marshlands Road and Willow Street** includes the eastern portion of the study area, and also features varied roadway characteristics, with more urban/suburban development and amenities – including a buffered sidewalk on the north side of the roadway – at the eastern end of the study area (Figure 5). Thornton Avenue is a divided four-lane roadway in this section. The portion of the segment that lies closer to Marshlands Road and that borders the Refuge is a two-lane undivided roadway and has a considerably more open character, with no development and no bike/ped accommodations on either side of the roadway.

Figure 5: Segment #2 - Thornton Avenue between Marshlands Road and Willow Street


**WHO IS USING THORNTON AVENUE?**

There are three primary groups of non-motorized users of Thornton Avenue:

**Commuters to Silicon Valley via the Dumbarton Bridge.** With the large number of jobs located on the Peninsula and the Dumbarton Bridge's status as the lone ped/bike Bay crossing, a significant number of bike commuters use Thornton Avenue to reach the bridge via Marshlands Road. A majority of these bike commuter trips originate from surrounding neighborhoods in Newark and from Fremont and Union City. Some bike commuters may also be coming from or going to the BART rail stations in Union City and Fremont.

**Recreational Cyclists.** A large number of bicyclists use Thornton Avenue to access the Refuge for recreational purposes, whether to ride on Refuge trails or to stage longer group rides. A majority of recreational bicyclists come from surrounding neighborhoods in Newark and from Fremont and Union City. Many bicyclists coming from Fremont use the bike lanes on Central Avenue, and then approach the Refuge on Thornton from the east.

**Pedestrians.** Pedestrians using Thornton Avenue to access the Refuge generally come from the surrounding neighborhoods. Pedestrians coming from the direction of Willow Street tend to be local residents. Those approaching from Gateway Boulevard tend to be a mix of residents, office workers, and hotel guests. A limited number of pedestrians access Thornton Avenue and the Refuge entrance via the "decommissioned" Old Jarvis Road.

## 2.2 PED/BIKE DATA

Pedestrian and bicycle counts were conducted on Thornton Avenue in the vicinity of the Refuge entrance during the morning and afternoon peaks on Thursday, July 18, 2013, and during the afternoon peak on Sunday, July 14, 2013 (Table 1). The weekday morning peak count was conducted from 6:00 am – 9:00 am, and the weekday afternoon peak count was conducted from 4:00 pm – 7:00 pm. The Sunday afternoon peak count was conducted from 3:30 pm – 6:30 pm.

**Table 1: Peak Period Pedestrian and Bicyclist Volumes**

| Period | Pedestrians | Bicyclists | Peds + Bikes |
|---|---|---|---|
| Weekday AM Peak | 10 | 32 | 42 |
| Weekday PM Peak | 4 | 60 | 64 |
| Sunday PM Peak | 18 | 29 | 47 |
| **Total** | **32** | **121** | **153** |

## 2.3 TRAFFIC DATA

The average annual daily traffic (AADT) on Thornton Avenue between Gateway Boulevard and Willow Street was 11,759 vehicles per day (vpd) in 2012. An afternoon peak hour count of heavy trucks on Thornton Avenue in the study area showed a total of 48 trucks with more than two axles. This count did not capture two-axle trucks, which constitute a significant proportion of the heavy truck traffic on Thornton Avenue.

## 2.4 CRASH DATA

An examination of crash data from the City of Newark shows that there were 15 reported crashes in the study area between January 2009 and December 2011 (Table 2). Of those 15 reported crashes, fewer than half resulted in injury, with no fatal crashes. There were no reported bicycle or pedestrian crashes during the three-year period for which data were available. However, it should be considered that reported crashes for pedestrians and bicyclists typically may not capture the entire crash and injury picture. Crash reporting may not capture bicycle-only or pedestrian-bicycle crashes that occur on the roadway.

**Table 2: Thornton Avenue Crashes by Injury Severity (2009-2011)**

| Year | Injury Crashes | PDO Crashes | Annual Total |
|---|---|---|---|
| 2009 | 4 | 3 | 7 |
| 2010 | 1 | 5 | 6 |
| 2011 | 2 | 0 | 2 |
| **3-year Total** | **7** | **8** | **15** |

Figure 6, Figure 7, and Figure 8 show the locations of reported crashes in the study area, along with information about time, date, roadway conditions, and lighting conditions.

**Figure 6: Crash Locations in the Vicinity of Thornton Avenue at Gateway Boulevard (2009-2011)**

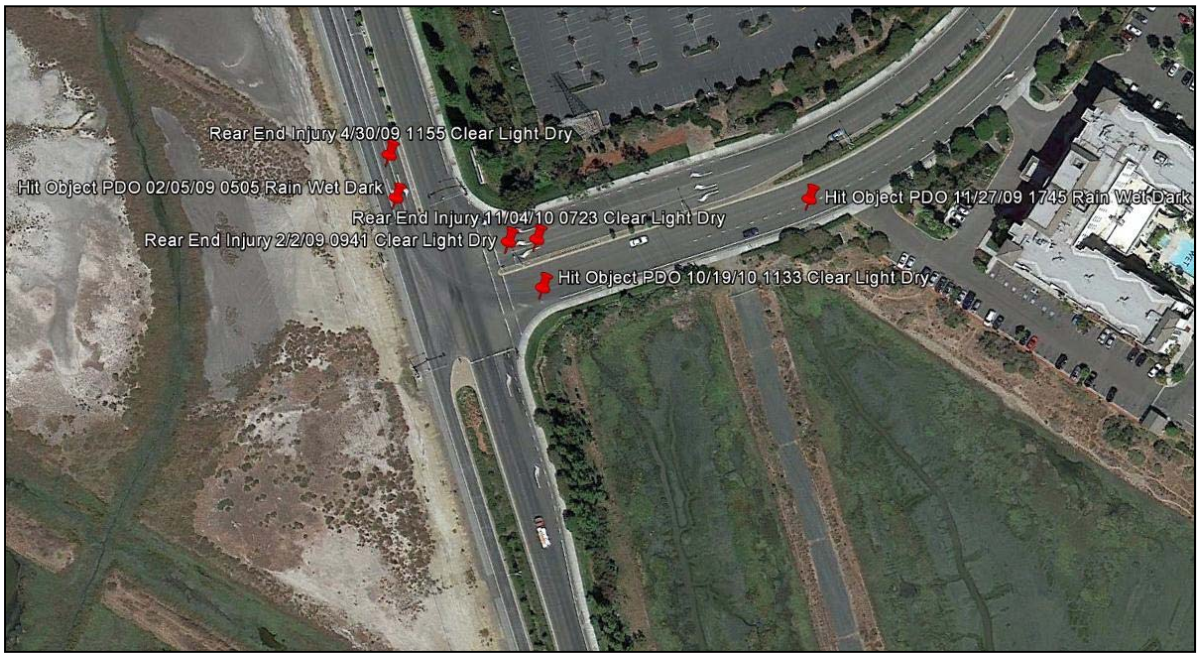



**Figure 7: Crash Locations in the Vicinity of Thornton Avenue at Marshlands Road (2009-2011)**

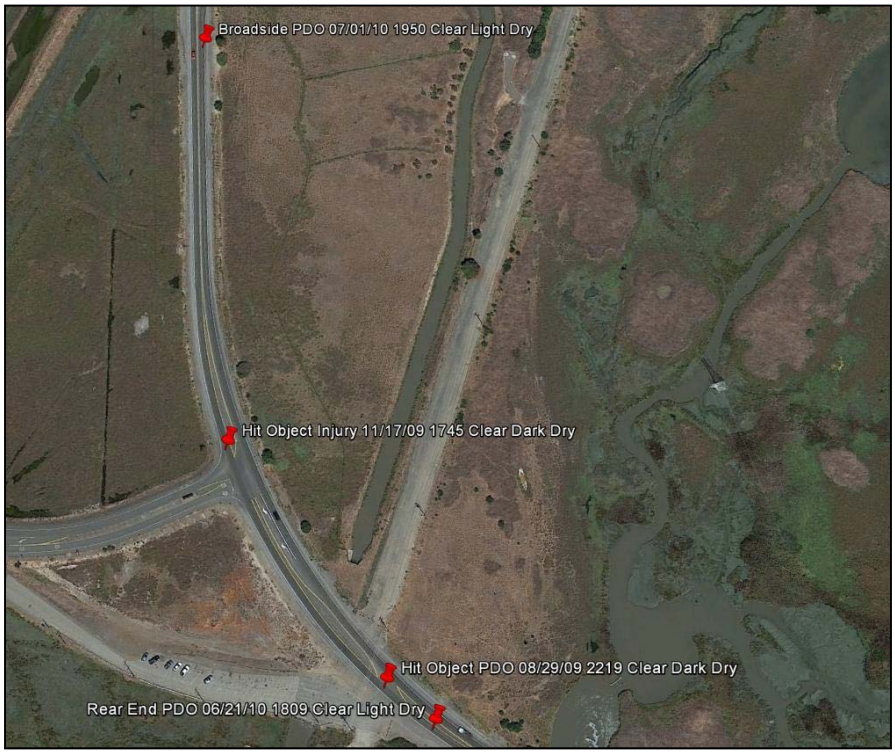
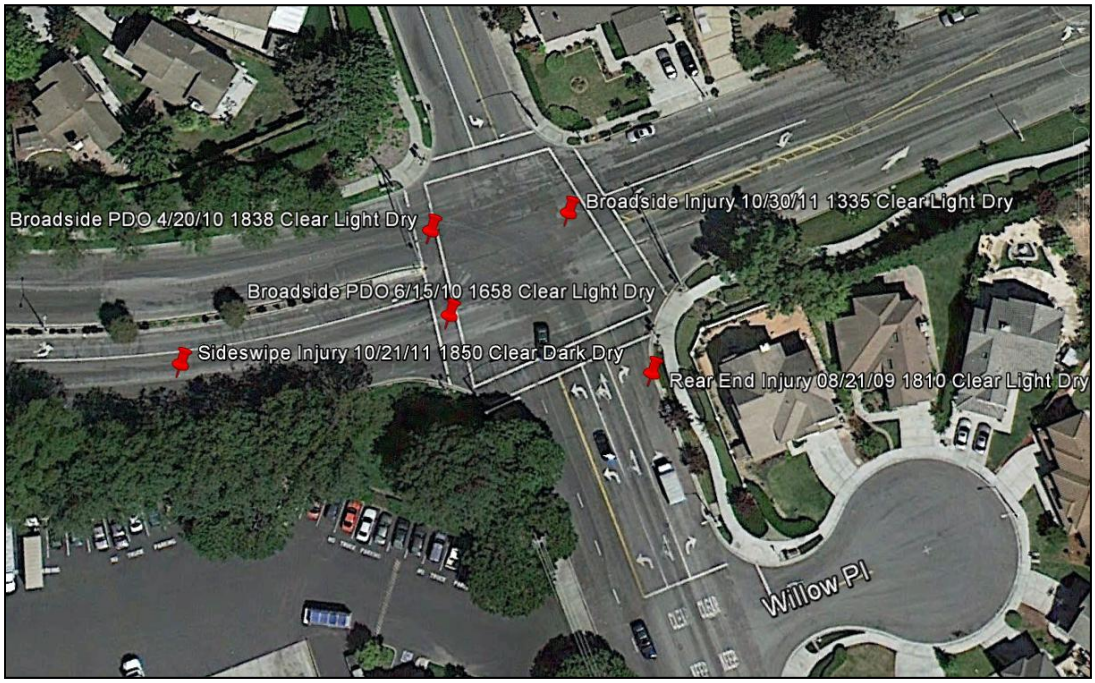


Figure 8: Crash Locations in the Vicinity of Thornton Avenue at Willow Street (2009-2011)




# 3. Assessment of Findings

## 3.1 Safety Benefits of Existing Roadway Features

**POSITIVE FEATURES**

**Condition of bike/ped facilities**

While there are gaps in the bike/ped facilities in the study area, the existing bike/ped facilities are in good condition. The sidewalks on the north side of Thornton Avenue at either end of the study area are in very good condition, and the sidewalks on the east end of the study area are buffered from the roadway. There is a well-maintained Class II bike facility on the north side of Thornton Avenue at the western end of the study area.

> There are three classes of bike facilities: a Class I facility is a bike path that is completely separated from the roadway; a Class II facility is a striped bike lane for one-way bike travel on a street or highway; a Class III facility is an on-road designated bike route that typically includes Bike Route signs and Share the Road plaques.

**Left-turn lane on Thornton Avenue at Marshlands Road**

The presence of a left-turn lane on Thornton Avenue at Marshlands Road provides separation for vehicles and bicyclists turning left into the Refuge and helps reduce congestion on WB Thornton Avenue.

**Bike connection to the Peninsula**

The Dumbarton Bridge represents the lone bike/ped route across San Francisco Bay. The only way to access that crossing is through the Refuge, with the only bike/ped access toMarshlands Road via Thornton Avenue. The study area thus plays a vital role in one of the most important bike/ped routes in the Bay Area.

**Some lighting at Refuge entrance**

While lighting is generally limited through much of the study area, there is some lighting present at the intersection of Thornton Avenue and Marshlands Road, thereby increasing nighttime visibility in the vicinity of the Refuge entrance.

**OPPORTUNITIES**

**Wide lanes and wide shoulders**

With the exception of a pinch point east of the Thornton Avenue/ Marshlands Road intersection, the existing shoulders on Thornton Avenue are relatively wide, with a paved shoulder 4 to 13 feet in width, and as much as 9 feet of additional gravel shoulder available in some locations. The combination of wide shoulders (both paved and gravel) and existing lane widths of 14 feet may provide an opportunity to repurpose existing lanes and shoulders to include bike/ped facilities on Thornton Avenue.

**Bay Trail**

The Bay Trail is a planned recreational corridor that will circle the San Francisco Bay and will encompass more than 500 miles of bicycling and hiking trails once complete. The proposed alignment of the Bay Trail runs through Don Edwards San Francisco Bay NWR. The planning and implementation of the Bay Trail connections to the Refuge represent a major opportunity to identify and implement additional bike/ped improvements in the study area. Specifically, the interim Bay Trail alignment calls for the trail to run on-street on Thornton Avenue from the Refuge entrance to Willow Street, which may provide an opportunity to improve Thornton Avenue by installing bike lanes (Class II bike facility) on the roadway.

**Separation of traffic via two access points**

The informal access point at the Cargill Lot provides separate Refuge access for bicycle traffic, as bicyclists coming from and going to the east on Thornton Avenue are able to shorten their route and avoid waiting with queuing traffic.

**Funding Opportunities**

The Refuge has a chance to coordinate activities with other projects and leverage multiple existing or potential funding sources to implement some of the measures identified as part of this RSA effort. Those sources include:

- **Marshlands Road improvements.** Caltrans has been awarded $2,256,000 in Federal Lands Access Program (FLAP) funding to replace the bridge on Marshlands Road and to reconstruct 600 meters of Marshlands Road between the bridge and Thornton Avenue. The Refuge will want to work with Caltrans to ensure that improvements related to the Marshlands Road/Thornton Avenue intersection identified in this RSA are considered as part of this project.

- **Future FLAP funding.** Central Federal Lands Highways is expected to issue a call for projects for FY2015. In anticipation of this funding opportunity, the Refuge should work closely with the City of Newark to develop an application for FLAP funds for multimodal improvements to Thornton Avenue, based on recommendations suggested as part of this RSA.

- **Bay Trail Grant Program.** The Refuge and the Bay Trail Project have begun to explore the possibility of pursuing a grant from the Bay Trail Grant Program to develop a feasibility study for pedestrian and bicycle improvements on Thornton Avenue. The Grant Program is targeted to projects that fill gaps in the Bay Trail system. A grant application would need to be submitted in Spring 2014.

## 3.2 CORRIDOR-WIDE ISSUES

Issues and concerns that apply to the entire Thornton Avenue study area are addressed in this section. Other location-specific issues and recommendations are addressed in Section 3.3.

**CONTRIBUTING FACTORS**

**Motor vehicle speeds.** Speed was identified as a primary contributing factor to elevated risk for pedestrians and bicyclists within the study area. The posted speed limit on Thornton Avenue is 45 mph, and, according to a speed study conducted by the City of Newark in 2012, the 85$^{th}$ percentile speed is 49 mph. Much of Thornton Avenue in the study area lacks marked bike lanes or buffered pedestrian facilities, and pedestrians and bicyclists must walk and ride in the shoulder or along an informal "goat path" on the north side of the roadway, both of which bring pedestrians and bicyclists within close proximity of motorized vehicles traveling at high speeds. While the observed speeds on Thornton Avenue are not greatly in excess of the posted speed limit, vehicle speeds in combination with the roadway character and geometry increase travel risk for pedestrians and bicyclists. Studies have shown that the probability of a pedestrian fatality as a result of a collision with a vehicle is increased from 5

percent to 85 percent as vehicle speed increases from 20 mph to 40 mph.[1] Motor vehicle lane widths and surrounding land use may contribute to motor vehicle speeds in the study area.[2]

Wide lanes on the WB approach to the Thornton/Gateway intersection.

**Lack of connectivity of existing ped/bike facilities.** As mentioned previously, the study area does include some bicycle and pedestrian facilities, located at either end of the corridor. However, these facilities end abruptly at the edge of the developed portions of the study area, causing pedestrians and bicyclists to navigate difficult conditions in order to travel Thornton Avenue or reach the Refuge entrance. There is also no marked crossing on Thornton Avenue in the vicinity of Marshlands Boulevard. The nearest marked crossing is at Thornton Avenue and Willow Street approximately 1.2 miles away, but a lack of pedestrian facilities on the south side of Thornton Avenue precludes safe access to the Refuge for pedestrians who may use this marked crossing.

A section of Thornton Avenue with no designated ped/bike facilities.

**Heavy truck traffic.** Thornton Avenue is a designated truck route and provides a connection between SR 84 freeway and industrial areas to the south and east of the study area. Heavy truck traffic can make for a hostile setting for pedestrians and bicyclists, particularly in the sections of Thornton Avenue that lack ped/bike facilities.

[1] *Killing Speed and Saving Lives*. U.K. Department of Transportation, London, 1987.

[2] Hauer, E. *Lane Width and Safety.* 2000.

Bicyclists exiting the Refuge wait for a gap in traffic as a tractor trailer passes on Thornton Avenue.

**Potential Improvements**

The RSA Team identified a number of improvements that would help mitigate the aforementioned corridor-wide contributing factors. In pursuing these improvements, the Refuge and other stakeholders will want to aim for the highest possible separation of motorized and non-motorized modes.

Short-term

- Increase speed enforcement on Thornton Avenue.
- Install bike warning signs with Share the Road plaques along the uncurbed section of Thornton Avenue.
- Undertake an education campaign to increase motorist awareness of pedestrians and bicyclists in the study area.
    - Do not speed – The potential severity of a crash relates directly to vehicle speed. Speed also affects the ability of motorists and non-motorized users to make eye contact and establish intent and the ability to prevent a crash by stopping before impact.
    - Watch for non-motorized users – Motorists should be aware that non-motorized users may be traveling along the roadway or crossing the roadway and have the ability to reach safely to such as situation.
    - Walk facing traffic – *A Study of Fatal Pedestrian Crashes in Florida* demonstrates that the likelihood of a crash is reduced by a factor between 1.5 to 4 times when walking facing traffic. The research reveals a disproportionate ratio of "pedestrian walking along the roadway" crashes involve pedestrians walking with traffic (approximately 3 to 1).[3]
    - Bike in the direction of vehicle travel – Cyclists may contribute to crashes by riding the wrong-way (against traffic). Nearly one-third of all cyclist collisions in a national study were associated with riding against traffic; for intersection collisions, the proportion was 42 percent.[4]

[3] Baltes, M.R. *A Study of Fatal Pedestrian Crashes in Florida.* Center for Urban Transportation Research, University of South Florida, Tampa, FL, 1996.

[4] Hunter, W.W., Stutts, J.C., Pein, W.E., and Cox, C.L. *Pedestrian and Bicycle Crash Types of the Early 1990s.* FHWA, McLean, VA, 1996.

- Wear retroreflective clothing or use a light – Walking during periods of darkness increases the risk of fatality by about seven times. Even when wearing brightly colored clothes, visibility at night without lighting or reflective materials often does not allow enough time to be seen by a driver, especially at higher speeds.[5]
- The Refuge and the City of Newark have explored the possibility of developing a Bike to Work Day education campaign.

Intermediate

- Repurpose lanes to create narrower motor vehicle lanes and a buffered 6' bike lane on both sides of the roadway for one-way bike travel for sections of Thornton Avenue that do not currently have designated bike facilities (Figure 9). Doing so would address both the issues of motor vehicle speeds and heavy truck traffic by providing a separate, buffered lane for bicyclists, while also providing full connectivity of Class II bike facilities along Thornton Avenue.
- The following improvements, if implemented in concert with one another, will help lower risk to pedestrians by providing a formal crossing on Thornton Avenue and a fully connected network of pedestrian facilities separated from the roadway, thus addressing all three primary contributing factors of motor vehicle speeds, heavy truck traffic, and lack of connectivity of pedestrian facilities.
  - Install a marked crosswalk with pedestrian signals across Thornton Avenue on the south leg of the Thornton/Gateway intersection. Install a landing area on the south/west side of Thornton Avenue.
  - Install a 2-way pedestrian facility (a buffered sidewalk or formal path separated from the roadway) on the south side of Thornton Avenue to connect the new marked crossing at Gateway Boulevard to the Refuge entrance at Marshlands Road.
  - Formalize the currently informal ped/bike Refuge access point at the west end of the corridor, on the south side of Thornton Avenue between Gateway Boulevard and Marshlands Road (Figure 9). Create a formal trail atop the levee to connect the newly formalized access point to Marshlands Road. Provide a connection between the newly formalized entrance and the new 2-way pedestrian facility on the south side of Thornton Avenue.
  - In coordination with the repaving of Thornton Avenue, install a 2-way pedestrian facility (a buffered sidewalk or formal path separated from the roadway) on the south side of Thornton Avenue between Willow Street and the Refuge entrance at Marshlands Road to provide connectivity for pedestrians accessing the Refuge from the east.
  - Conduct a study to determine the need for a formal crossing on Thornton Avenue at Hickory Street to facilitate crossings for pedestrians coming from planned Cedar Boulevard Extension linear park.

[5] Sullivan, J. and Flannagan, M. *Implications of Fatal and Nonfatal Crashes for Adaptive Headlighting.* University of Michigan Transportation Research Institute, Ann Arbor, MI, 2006.

**Figure 9: Potential Intermediate-term Corridor-wide Improvements on Thornton Avenue**


The RSA Team considered the potential for creating an informal ped/bike Refuge access point at the east end of the corridor – located just west of the intersection of Thornton Avenue and Hickory Street – which would provide access to existing Refuge trails that connect to Marshlands Road. After careful consideration, the RSA Team determined that pedestrian and bicycle connectivity along Thornton Avenue would be best served by on-road facilities at this time. Future planning efforts might consider that connection in coordination with FWS and Cargill.

## OVERARCHING CONCERNS

The RSA team identified a number of overarching concerns that will need to be taken into consideration in addressing safety issues in the study area.

**Ownership of connecting facilities and adjacent property** represents a challenge to implementing improvements suggested in this RSA due to the variety of facility and land owners in the study area(Figure 10). For instance, Thornton Avenue is owned and maintained by the City of Newark, while Marshlands Road is owned and maintained by the California Department of Transportation (Caltrans). The Cargill Lot is owned by Cargill, although there are questions about which party is responsible for maintaining the lot. The undeveloped parcel at the corner of Thornton Avenue and Gateway Boulevard is owned by the Gateway Property Owners Association. The undeveloped parcel just northwest of Old Jarvis is listed in the assessor's map as being owned by Leslie Salt Company, which was purchased by

Cargill in the late 1970s. The Refuge itself, meanwhile, is located in the City of Fremont. The Refuge will need to coordinate with the appropriate stakeholders about potential improvements to the study area.

**Figure 10: Land and Transportation Facility Ownership in the Study Area**


The relative complexity of the ownership status of the various facilities and landholdings will make **outreach to stakeholders** particularly critical to efforts to improve Thornton Avenue, Marshlands Road, and the Cargill Lot. FWS, the City of Newark, Caltrans, and Cargill will need to work closely to align planning efforts and implement improvements in a consistent and coordinated fashion.

**Right of way is constrained** in several portions of the study area, particularly where Thornton Avenue abuts the Refuge. These constraints will pose challenges to any plans to widen Thornton Avenue in order to provide bike/ped facilities separated from traffic.

**TRANSITION POINTS**

The character of Thornton Avenue changes significantly in multiple places in the study area due to roadway characteristics and adjacent land use. The two ends of the study area – in the vicinity of the Thornton Avenue/Gateway Boulevard intersection and in the vicinity of the Thornton Avenue/Willow Street intersection – are more urban/suburban in character, are bounded by residential and industrial areas, and feature medians, curbs, and some bike/ped accommodations. The portion of Thornton Avenue between these two urban/suburban bookends is considerably less urban/suburban and more open – due to the fact that it borders the Refuge in this section – with no adjacent development and no designated bike/ped accommodations.

These transition points pose a significant challenge to pedestrian and bicyclist safety in the study area, as they mark locations where the bike/ped facilities end and the roadway narrows considerably, making accessing the Refuge particularly difficult for these roadway users.

**FUTURE GROWTH**

The study area could see a sizeable increase in the level of pedestrian and bicycle activity due to existing and planned development in nearby communities (Figure 11). This increase in bike/ped activity could exacerbate safety issues in the corridor, given the lack of connectivity of ped/bike facilities in the area.

The **Dumbarton TOD** project is a proposed high-density development that could break ground in 2014, with approximately 500 units slated for the initial phase and up to 2500 units at full build-out. The project will be located just south of the Refuge, with access via Willow Street.

The **Pacific Research Center**, an office park located on Gateway Boulevard east of Thornton Avenue, has seen its occupancy increase rapidly over the past year. That occupancy rate, currently at 75 percent, is expected to continue to rise. The Pacific Research Center would like to view the Refuge as an amenity for its tenants.

**Aloft**, a boutique hotel located on Gateway Boulevard just east of Thornton Avenue, is promoting the Refuge to its guests, including a hiking package and a potential bike rental.

**Menlo Park**, located just across San Francisco Bay from the Refuge and easily accessible via the Dumbarton Bridge, is home to the new Facebook headquarters. With additional tech firms expected to locate in Menlo Park in order to take advantage of the proximity to Facebook's offices, the cities of Newark and Fremont are expecting an increase in residents as employees seek more affordable housing in the East Bay. Such developments would likely lead to increased commuter traffic on Thornton Avenue and Marshlands Road.

The **Bay Trail,** a planned recreational corridor that goes through the Refuge, is expected to bring an increase in bicyclist and pedestrian traffic to the Refuge as sections are improved and connectivity is increased.

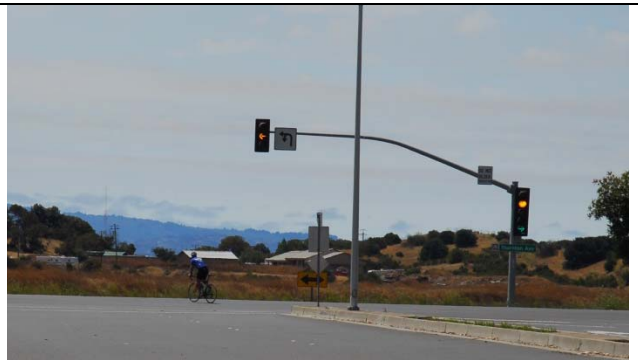
The City of Newark is planning a **linear park on the Cedar Boulevard extension** located northeast of the study area. This linear park will be accessible from the eastern end of the study area, and has the potential to increase pedestrian and bicyclist traffic on Thornton Avenue.

**Figure 11: Potential Contributors to Future Ped/Bike Traffic Growth**

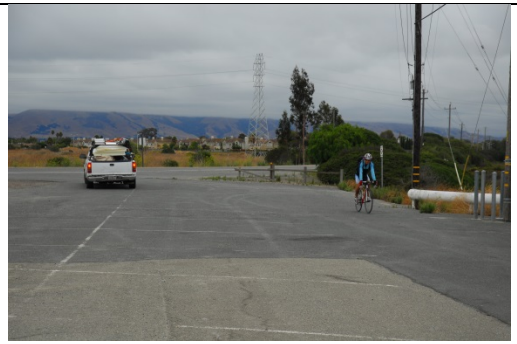
## 3.3 LOCATION-SPECIFIC ISSUES

**INTERSECTION #1: THORNTON AVENUE AT GATEWAY BOULEVARD**

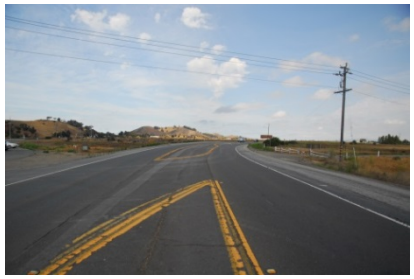
| NO. | ISSUE/CONCERN | EXAMPLE OF ISSUE | POTENTIAL IMPROVEMENTS TO BE CONSIDERED |
|---|---|---|---|
| 1a | **No marked crossing across Thornton Avenue** – While there is a marked crosswalk and pedestrian signal across Gateway Boulevard on the east leg of the intersection, there are no pedestrian accommodations for crossing Thornton Avenue. The only formal crossing in the study area is located at Thornton Avenue and Willow Street, which is 1.2 miles from the Thornton/Gateway intersection. |  ***The south leg of the intersection of Thornton Avenue and Gateway Boulevard. Both the north leg and south leg of the intersection lack a marked crossing and pedestrian signals.*** | ***Intermediate –*** Consider installing a marked crosswalk and pedestrian signals across Thornton Avenue on the south leg of the intersection. Crosswalk and ped signal installation should be considered in conjunction with potential receiving facilities on west side of Thornton Avenue, including a two-way pedestrian facility (a sidewalk or path separated from the roadway) on the south/west side of Thornton Avenue. See item 1b. See also the section on potential corridor-wide improvements. |
| 1b | **No receiving facilities on west side of Thornton Avenue –** There currently are no separated pedestrian facilities on the west side of Thornton Avenue in the vicinity of the Thornton Ave./Gateway Blvd. intersection. Ideally, two-way facilities for pedestrians should be provided if a formal crossing is installed. |  ***This view, looking southbound/eastbound on Thornton Avenue, shows the absence of bike/ped facilities on the south/west side of Thornton Ave.*** | ***Intermediate –*** Consider installing accessible landing area and connecting pedestrian facilities on west/south side of Thornton Avenue. Installation of landing area and ped/bike facilities should be considered in conjunction with a potential marked crosswalk and pedestrian signals on south leg of the intersection as well as a two-way pedestrian facility on the south/west side of Thornton Avenue. See item 1a. See also the section on potential corridor-wide improvements. |

| NO. | ISSUE/CONCERN | EXAMPLE OF ISSUE | POTENTIAL IMPROVEMENTS TO BE CONSIDERED |
|---|---|---|---|
| 2 | **Green time for WB left-turning bicyclists –** Bicyclists turning left from WB Gateway Blvd. onto SB/EB Thornton Ave. may not have sufficient green time to move through the intersection and complete their turn. As a result, bicyclists may face conflicts with SB/EB vehicles, which may receive a green signal while the bicyclist is still completing his or her turn. |  ***A cyclist is only partway through his left turn onto SB/EB Thornton Avenue as the signal turns yellow.*** | ***Short-term –*** Work with the City of Newark to review whether current signal timing allows for WB left-turns for bicyclists at the intersection. |

**INTERSECTION #2: THORNTON AVENUE AT REFUGE ACCESS POINTS (MARSHLANDS ROAD AND CARGILL LOT)**

| NO. | ISSUE/CONCERN | EXAMPLE OF ISSUE | POTENTIAL IMPROVEMENTS TO BE CONSIDERED |
|---|---|---|---|
| 1 | **Limited sight distance –** Sight distance is limited for vehicles, bicyclists and pedestrians exiting the Refuge due to the curvature of Thornton Avenue and due to vegetation. |  ***Roadway curvature and vegetation limit sight distance for vehicles, cyclists and pedestrians exiting the Refuge at either Marshlands Road or the Cargill Lot.*** | ***Short-term –*** Consider removing vegetation along inside of curve in vicinity of Thornton Ave./Marshlands Rd. intersection to increase sight distance. |
| 2 | **Intended use of Cargill Lot –** The undefined nature of the Cargill lot results in uses that lead to conflicts between motorists, cyclists and pedestrians, both in the lot and at the access to Thornton Avenue. The lot currently is used for Refuge access/egress by bicyclists and occasionally by motorists; for boat ramp access; and for parking (including overnight parking). |  ***A cyclist enters the Refuge via the Cargill Lot as a pickup truck exits the lot onto Thornton Avenue. The faded striped parking spaces are visible in the photo.*** | ***Short-term –*** Restrict left turns out of the Cargill lot. Remove gap in centerline pavement markings on Thornton Avenue. Existing gap in centerline permits vehicles to turn left out of Cargill Lot onto WB Thornton Avenue. See item 4.<br>***Short-term*** – Install a stop sign at the Cargill lot exit.<br>***Intermediate*** – Consider restricting access to the Cargill Lot from Thornton Avenue. Consider eliminating motor vehicle access to the lot from Thornton Avenue, but allowing for bicycle egress from the lot onto EB Thornton Avenue. See item 4.<br>***Intermediate*** – More clearly designate parking |

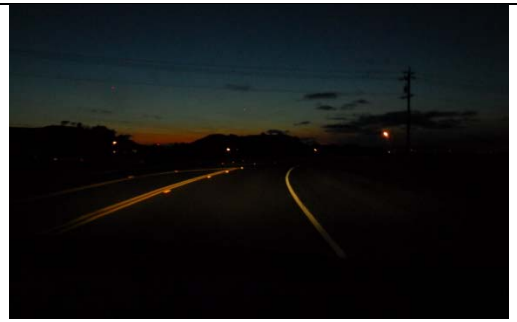
| NO. | ISSUE/CONCERN | EXAMPLE OF ISSUE | POTENTIAL IMPROVEMENTS TO BE CONSIDERED |
|---|---|---|---|
| | |  ***The boat launch at the southeast corner of the Cargill Lot.*** | lot use in conjunction with potential closure of lot access from Thornton Avenue.<br>***Intermediate to Long-term*** – Coordinate with Cargill to transfer Cargill Lot land to FWS. |
| **3** | **Crossings to and from Old Jarvis –** Pedestrians and bicyclists use the decommissioned road opposite the Cargill Lot – termed "Old Jarvis" for the purposes of this report – to access the Refuge. In doing so, pedestrians and bicyclists must cross Thornton Avenue using the unmarked crossing at Marshlands Road, which is located on a curve with high vehicle speeds and limited sight distance. |  ***A jogger crosses Thornton Avenue to enter Old Jarvis after exiting the Refuge.*** | ***Short-term*** – Conduct a study to determine the appropriate traffic control – e.g. pedestrian hybrid beacon (HAWK) or full signal – for the intersection of Thornton Avenue and Marshlands Road based on existing volumes (AADT was 11,759 vpd in 2012). Based on ADT and ped/bike volumes, a marked crossing without significant traffic control may create a condition that places crossing peds/bikes at higher risk. See Appendix A for a table of recommendations for installing marked crosswalks at uncontrolled locations. |
| **4** | **Multiple access points** – Although Marshlands Road is marked as the main Refuge entrance, motorists, bicyclists and pedestrians use both Marshlands Road and the Cargill Lot for Refuge access. Bicyclists, in particular, were observed entering and exiting the Refuge at the Cargill Lot in order to limit time spent riding on Thornton Avenue. A majority of vehicular traffic enters and exits the Refuge at Marshlands |  ***The NB approach on Marshlands Road has a single lane with separate STOP pavement markings for left-*** | ***Short-term*** – Consider providing separate left-turn and right-turn lanes on Marshlands Road at Thornton Avenue.<br>***Short-term*** – Remove gap in centerline pavement markings on Thornton Avenue. Existing gap in centerline permits vehicles to turn left out of Cargill Lot onto WB Thornton Avenue. See item 2. |

| NO. | ISSUE/CONCERN | EXAMPLE OF ISSUE | POTENTIAL IMPROVEMENTS TO BE CONSIDERED |
|---|---|---|---|
| | Road, although motorists were observed using the Cargill Lot for right turns onto EB Thornton Avenue. The Refuge's multiple access and egress points lead to confusion and conflicts among motorists, bicyclists and pedestrians, particularly since motorists on Thornton Avenue may not be expecting two access points located within such close proximity to one another. | ***turning and right-turning vehicles.***<br>  <br>***Pavement markings on Thornton Avenue include a marked left turn out of the Cargill Lot (on the left).*** | ***Intermediate*** – Consider restricting access to the Cargill Lot from Thornton Avenue. Consider eliminating motor vehicle access to the lot from Thornton Avenue, but allowing for bicycle egress from the lot onto EB Thornton Avenue. See item 2.<br>***Intermediate*** – Consider repurposing lanes to create narrower motor vehicle lanes and a buffered 6' bike lane on both sides of the roadway for one-way bike travel for sections of Thornton Avenue that do not currently have designated bike facilities.<br>***Intermediate*** – Consider installing two-way pedestrian facilities on south side of Thornton Avenue, per recommendations in Corridor-Wide Issues section. |
| **5** | **Bikes riding the wrong way on Thornton Avenue to enter Refuge** – Currently, WB bicyclists often cross Thornton Avenue in advance of the Refuge entrance and then ride the wrong way along Thornton Avenue in order to enter the Refuge via the Cargill Lot. |  <br>***A bicyclist enters the Refuge after having ridden against traffic on Thornton Avenue.*** | ***Intermediate*** – Include safety messages on maps showing designated bicycle facilities. |

| NO. | ISSUE/CONCERN | EXAMPLE OF ISSUE | POTENTIAL IMPROVEMENTS TO BE CONSIDERED |
|---|---|---|---|
| 6 | **Conflicts at right-turn from EB Thornton** – Currently, EB right-turning motorists use a portion of the shoulder of Thornton Avenue as an informal turning lane as they decelerate to enter the Refuge at Marshlands Boulevard. This puts them in conflict with bicyclists riding on the shoulder, as well as with through vehicles on Thornton Avenue, as the limited shoulder width does not allow for right-turning vehicles to move fully out of the travel lane. |  ***A vehicle turning right to enter the Refuge uses the shoulder to decelerate, while another vehicle passes on its left.*** | ***Short-term*** – Consider installing bicycle warning signs with Share the Road plaques in the vicinity of the Refuge entrance.<br><br>***Intermediate*** – Consider repurposing lanes to create narrower motor vehicle lanes and a buffered 6' bike lane on both sides of the roadway for one-way bike travel for sections of Thornton Avenue that do not currently have designated bike facilities.<br><br>**Intermediate to Long-term –** In coordination with repaving of Thornton Avenue, consider shifting and narrowing motor vehicle lanes to accommodate a buffered 6' bike lane on both sides of the roadway and to create a right turn lane on EB Thornton at Marshlands Road. |

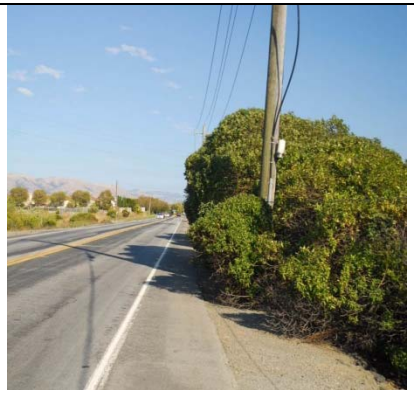
**SEGMENT #1: THORNTON AVENUE – GATEWAY BOULEVARD TO MARSHLANDS ROAD**

| NO. | ISSUE/CONCERN | EXAMPLE OF ISSUE | POTENTIAL IMPROVEMENTS TO BE CONSIDERED |
|---|---|---|---|
| 1 | **Lack of continuity of bicycle/pedestrian facilities** – There is a sidewalk and a bike lane on the north/east side of Thornton Avenue in the vicinity of the intersection at Gateway Boulevard. However, these facilities end abruptly approximately ¼ mile east/south of the intersection. This lack of continuity of bike/ped facilities means that bicyclists must ride and pedestrians must walk in the shoulder for much of the section between the Thornton/Gateway intersection and the Refuge entrance. There are no bike/ped facilities on the south/west side of Thornton Avenue. |  ***This view of Thornton Avenue east/south of the intersection at Gateway Blvd. shows the transition from no bike/ped facilities to a sidewalk and marked bike lane.*** | ***Short-term*** – Install bike warning signs with Share the Road plaques in the section of Thornton Avenue with no designated bike/ped facilities.<br>***Intermediate*** – Consider repurposing lanes to create narrower motor vehicle lanes and a buffered 6' bike lane on both sides of the roadway for one-way bike travel for sections of Thornton Avenue that do not currently have designated bike facilities.<br>***Intermediate*** – Consider installing two-way pedestrian facilities on south side of Thornton Avenue, per recommendations in Corridor-Wide Issues section. |
| 3 | **Signage** – Signs along Thornton Avenue lack retroreflectivity, making them difficult to see at night. There is also a "Divided Highway Ends" sign on EB Thornton Avenue that is upside down. |  ***A speed limit sign along Thornton Avenue lacking retroreflectivity.*** | ***Short-term*** – Replace current signs with retroflective signs.<br>***Short-term*** – Reinstall "Divided Highway Ends" sign so that it is oriented properly. |

| NO. | ISSUE/CONCERN | EXAMPLE OF ISSUE | POTENTIAL IMPROVEMENTS TO BE CONSIDERED |
|---|---|---|---|
| | |  ***A "Divided Highway Ends" sign on EB Thornton Avenue is oriented upside down.*** | |
| **4** | **Limited lighting** – There is limited lighting along Thornton Avenue in this section of the study area, leading to poor visibility in dark conditions. |  ***Limited lighting along Thornton Avenue results in low nighttime visibility.*** | ***Short-term*** - Undertake an education campaign to increase motorist awareness of pedestrians and bicyclists in the study area, including recommendation on wearing retroreflective clothing or using a light. For more detail, see possible short-term improvements in the Corridor-Wide Issues section. |

**SEGMENT #2: THORNTON AVENUE – MARSHLANDS ROAD TO WILLOW STREET**

| NO. | ISSUE/CONCERN | EXAMPLE OF ISSUE | POTENTIAL IMPROVEMENTS TO BE CONSIDERED |
|---|---|---|---|
| 1 | **Narrow shoulder, drop off** – The shoulder on the south side of Thornton Avenue is 4 feet wide at its narrowest point, and is not wide enough to safely accommodate pedestrians or bicyclists. This lack of accommodation is exacerbated by a 4- to 5-inch drop off on the south side of the roadway. |  <br>***The narrow shoulder on the south side of Thornton Avenue (right side in the photo) increases travel risk for pedestrians and bicyclists.***<br>  <br>***The drop off on the south side of Thornton Avenue measures between 4 and 5 inches.*** | ***Intermediate*** – Consider restriping lanes to provide wider shoulder.<br>***Intermediate*** – Install a safety edge to create a tapered roadway edge and eliminate the drop off.<br>***Intermediate*** – Consider widening shoulder as part of scheduled repaving of Thornton Avenue. |

| NO. | ISSUE/CONCERN | EXAMPLE OF ISSUE | POTENTIAL IMPROVEMENTS TO BE CONSIDERED |
|---|---|---|---|
| 2 | **Overhanging vegetation** – Vegetation overhanging the roadway further narrows the effective width of the shoulder and makes it impassable for pedestrians and bicyclists, who must walk or ride in the travel lane to get past the overgrowth. |  ***Vegetation overhanging the shoulder on EB Thornton Avenue.*** | ***Short-term*** – Trim vegetation on south side of Thornton Avenue to two feet from the edge of the shoulder. |
| 3 | **Lack of continuity of bicycle/pedestrian facilities** – There is a sidewalk on the north side of Thornton Avenue in the vicinity of the intersection at Willow Street. However, the sidewalk ends approximately 4/10 mile west of the intersection. This lack of continuity of pedestrian facilities means that pedestrians must walk along an informal path (a.k.a. "goat trail") for much of the section between the Thornton/Willow intersection and the Refuge entrance. There are no bicycle facilities in this section of the study area, and there are no pedestrian facilities on the south side of Thornton Ave. |  ***The end of pedestrian facilities at the east end of the study area is accompanied by a dropped lane on WB Thornton Avenue.*** | ***Short-term*** – The travel lanes are wide – in excess of 16 feet – in both directions on Thornton Avenue near Willow Street, with wide shoulders in addition to the wide lanes. Consider striping bike lanes on both sides of the roadway at the eastern end of the study area.<br>***Short-term*** – Install bike warning signs with Share the Road plaques in the section of Thornton Avenue with no designated bike/ped facilities.<br>***Intermediate*** – Consider repurposing lanes to create narrower motor vehicle lanes and a buffered 6' bike lane on both sides of the roadway for one-way bike travel for sections of Thornton Avenue outside of the suburban roadway cross-section.<br>***Intermediate*** – Consider installing two-way |

| NO. | ISSUE/CONCERN | EXAMPLE OF ISSUE | POTENTIAL IMPROVEMENTS TO BE CONSIDERED |
|---|---|---|---|
| | | | pedestrian facilities on south side of Thornton Avenue, per recommendations in Corridor-Wide Issues section. |
| **4** | **Pedestrians walking with back to traffic** – Due to the presence of a goat trail on the north side of Thornton Avenue, most pedestrians opt to walk on the north side of the roadway regardless of their direction of travel, rather than navigate the narrow shoulder and drop off on the south side of the roadway. This means that pedestrians walking WB on the north side of Thornton Avenue are walking with their backs to traffic, a practice that leads to significantly increased risk of pedestrian fatality. |  ***A pedestrian walks with her back to traffic along the goat trail on the north side of Thornton Avenue.*** | ***Short-term*** - Undertake an education campaign to increase motorist awareness of pedestrians and bicyclists in the study area, including information on increased risk to pedestrians from walking with their back to traffic. For more detail, see possible short-term improvements in the Corridor-Wide Issues section.<br><br>***Intermediate*** – Consider installing two-way pedestrian facilities on south side of Thornton Avenue, per recommendations in Corridor-Wide Issues section. |
| **5** | **WB bicyclists riding against traffic** – Currently, WB bicyclists often cross Thornton Avenue in advance of the Refuge entrance and then ride the wrong way in order to enter the Refuge via the Cargill Lot. | | ***Intermediate*** – Consider repurposing lanes to create narrower motor vehicle lanes and a buffered 6' bike lane on both sides of the roadway for one-way bike travel for sections of Thornton Avenue that do not currently have designated bike facilities. |

# 4. CONCLUSION

As part of this Pedestrian and Bicycle Road Safety Audit, the RSA Team identified issues that affect pedestrian and bicycle safety along Thornton Avenue. The primary issues include speed of motorized traffic, lack of connectivity of existing pedestrian and bicycle facilities, and heavy truck traffic along Thornton Avenue.

Engineering, education, and enforcement suggestions have been provided for each of the safety issues and have been categorized into short, intermediate, and long range implementation time frames. Don Edwards San Francisco Bay National Wildlife Refuge staff and the City of Newark, CA, are invited to consider work with other stakeholders in addressing the issues documented in this report.

Opportunities to coordinate activities with other projects and leverage multiple existing or potential funding sources to implement some of the improvement measures identified as part of this RSA effort should be explored. Those sources include the Marshlands Road Bridge and Access Improvement project, future FLAP funding, and the Bay Trail grant program. Regular meetings to coordinate the potential activities are encouraged.

# APPENDIX A

**Table 11. Recommendations for installing marked crosswalks and other needed pedestrian improvements at uncontrolled locations.***

| Roadway Type (Number of Travel Lanes and Median Type) | Vehicle ADT ≤ 9,000 | | | Vehicle ADT >9,000 to 12,000 | | | Vehicle ADT >12,000–15,000 | | | Vehicle ADT > 15,000 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Speed Limit** | | | | | | | | | | | |
| | ≤ 48.3 km/h (30 mi/h) | 56.4 km/h (35 mi/h) | 64.4 km/h (40 mi/h) | ≤ 48.3 km/h (30 mi/h) | 56.4 km/h (35 mi/h) | 64.4 km/h (40 mi/h) | ≤ 48.3 km/h (30 mi/h) | 56.4 km/h (35 mi/h) | 64.4 km/h (40 mi/h) | ≤ 48.3 km/h (30 mi/h) | 56.4 km/h (35 mi/h) | 64.4 km/h (40 mi/h) |
| Two lanes | C | C | P | C | C | P | C | C | N | C | P | N |
| Three lanes | C | C | P | C | P | P | P | P | N | P | N | N |
| Multilane (four or more lanes) with raised median*** | C | C | P | C | P | N | P | P | N | N | N | N |
| Multilane (four or more lanes) without raised median | C | P | N | P | P | N | N | N | N | N | N | N |

* These guidelines include intersection and midblock locations with no traffic signals or stop signs on the approach to the crossing. They do not apply to school crossings. A two-way center turn lane is not considered a median. Crosswalks should not be installed at locations that could present an increased safety risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing. These are general recommendations; good engineering judgment should be used in individual cases for deciding where to install crosswalks.

** Where the speed limit exceeds 64.4 km/h (40 mi/h), marked crosswalks alone should not be used at unsignalized locations.

*** The raised median or crossing island must be at least 1.2 m (4 ft) wide and 1.8 m (6 ft) long to serve adequately as a refuge area for pedestrians, in accordance with MUTCD and American Association of State Highway and Transportation Officials (AASHTO) guidelines.

**C = Candidate sites for marked crosswalks.** Marked crosswalks must be installed carefully and selectively. Before installing new marked crosswalks, an engineering study is needed to determine whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations, while a more indepth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, and other factors may be needed at other sites. It is recommended that a minimum utilization of 20 pedestrian crossings per peak hour (or 15 or more elderly and/or child pedestrians) be confirmed at a location before placing a high priority on the installation of a marked crosswalk alone.

**P = Possible increase in pedestrian crash risk may occur if crosswalks are added without other pedestrian facility enhancements.** These locations should be closely monitored and enhanced with other pedestrian crossing improvements, if necessary, before adding a marked crosswalk.

**N = Marked crosswalks alone are insufficient, since pedestrian crash risk may be increased by providing marked crosswalks alone.** Consider using other treatments, such as traffic-calming treatments, traffic signals with pedestrian signals where warranted, or other substantial crossing improvement to improve crossing safety for pedestrians.

Source: Zegeer, C.V. et al. *Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations: Final Report and Recommended Guidelines.* FHWA Office of Safety Research and Development, McLean, VA, 2005.